Techniques of Oropharyngeal Brachytherapy

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Oropharynx Brachytherapy

- One of the most challenging site for brachytherapy
- Limited access
- Proximity to critical structures: carotids
- Sites: Base of Tongue
  Tonsil
  Soft palate
  Ulvula

Challenges in Oropharynx brachytherapy

- limitations of anatomical site,
- small volume of involved structures,
- close location of critical organs (from both surgical and radiotherapy point)
- standard basic geometry not possible,
- intensive post-op care
- modifications required in conventional BRT rules

Intent of Treatment

- Radical : Brachytherapy alone as treatment: T1 tumors of ulvula, soft palate
- Boost: EBRT → Brachytherapy to boost dose to the primary.
- Palliative: As salvage in cases irradiated before with recurrences and unfit for surgery.
- In view of high propensity of the neck nodes in the range of 20-30% even in early stage: Combination of EBRT+ Brachytherapy preferred

Pre-Treatment Assessment

- Primary Tumor:
  - Exact extent of tumour to be determined.
  - Clinical examination, EUA- to assess mucosal extensions
  - Depth assessment important.
  - Imaging: CT scan/ MRI.
  - r/o other lesions in the region (synchronous 2nd primary).

- Neck Assessment :
  - Clinical examination
  - USG neck
  - CT/MRI

Instruments for brachytherapy

Pre Treatment: Technical Points

- Feasibility for Brachytherapy:
  - » Mouth opening,
  - » Dental status: Capping of sharp teeth, removal of teeth which can obstruct access
  - » Proximity of bones to implant site and
  - » requirement of dental shields/spacers.
- Requirement of tracheostomy: Epiglottis implants.
- Fitness for anesthesia.

Preparation before brachytherapy

- Appropriate Positioning
- Head extended, ring under head &towel roll under shoulder
- Check patency of airway before induction: Nasal Intubation
- Cuffed endotracheal tube
- Throat pack (Remember to Remove!)

Oedema can cause

airway obstruction

distortion of implant geometry

pain

If there is significant oedema then add steroids along with NSAIDS

Target volume and needle placement

- CTV is usually based upon the original extent of disease before delivery of EBRT or chemotherapy.
- Placement of radio-opaque markers before starting therapy can be very helpful to delineate the target volume, before any shrinkage occurs.
- Brachytherapy catheters should be placed about 0.8 to 1.2 cm apart as equidistant and parallel as possible

Contents lists available at ScienceDirect

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journal homepage: www.thegreenjournal.com

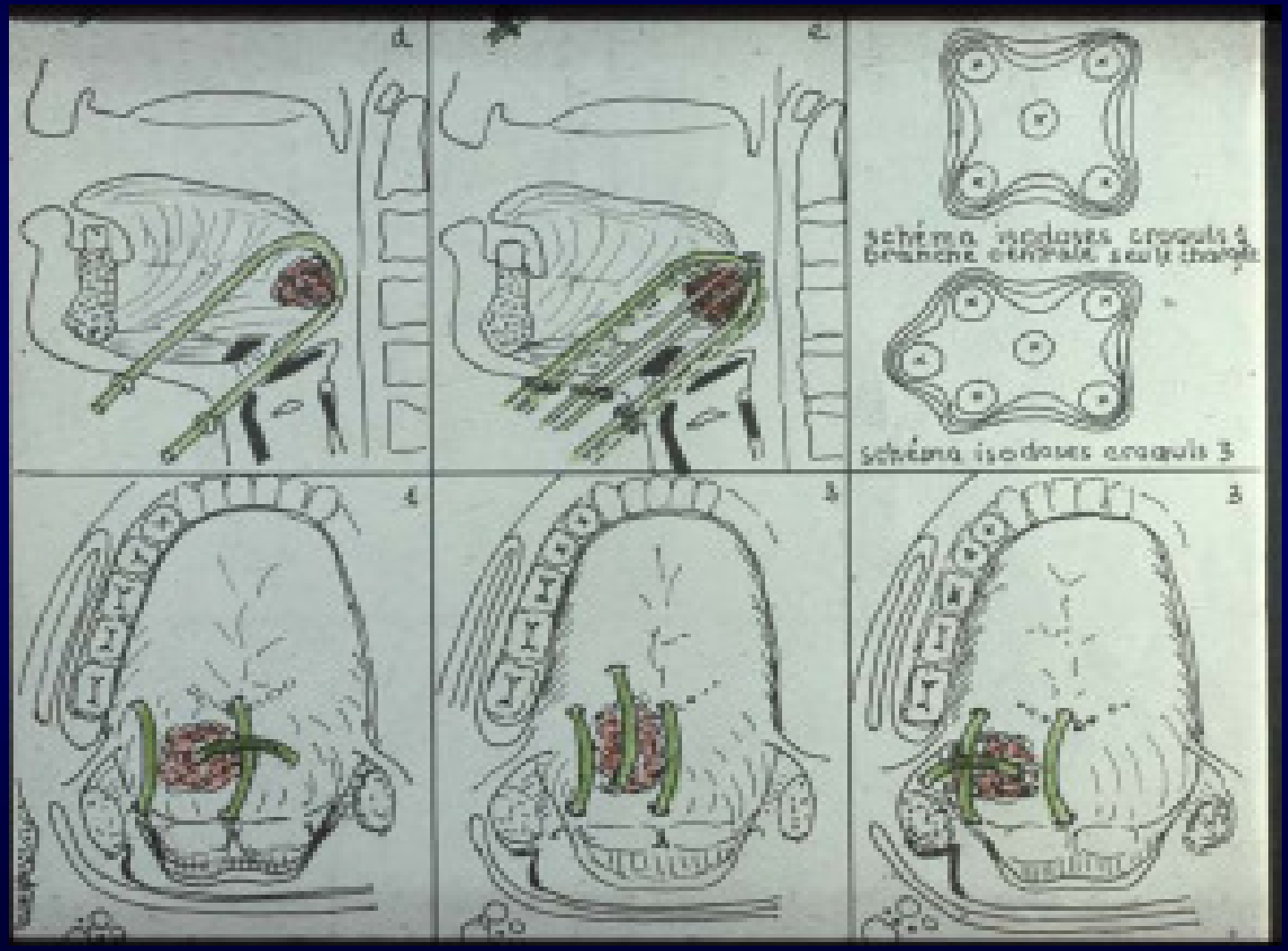
GEC-ESTRO recommendations

GEC-ESTRO recommendations for brachytherapy for head and neck squamous cell carcinomas

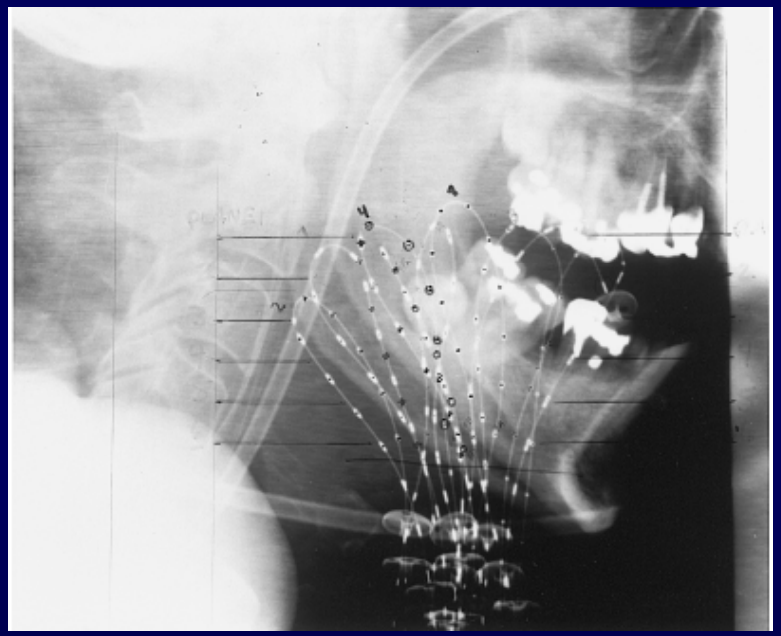
Jean-Jacques Mazeron [a,*], Jean-Michel Ardiet [b], Christine Haie-Méder [c], György Kovács [d], Peter Levendag [e], Didier Peiffert [f], Alfredo Polo [g], Angels Rovirosa [h], Vratislav Strnad [i]

Description of the clinical conditions, including GTV and CTV
Description of the technique (is the application performed following a system ?)
Source specification, including RAKR (Reference Air Kerma Rate) and TRAK (Total Reference Air Kerma)
Complete description of the time-dose pattern
Treatment description
Mean central dose (MCD), Minimum Target Dose, Homogeneity Index
Volumes and their dimensions, including PTV, Treated Volume, high-dose regions, low-dose regions, reference volume, irradiated volume (level 2)
Coverage and conformity if possible
Organs at risks

Base of tongue brachytherapy: Loop technique
Antero-Posterior Loops



Base of tongue brachytherapy: Loop technique
Side to side Loops



Technique of Base of tongue brachytherapy: Non Loop techniques

Techniques: Plastic Tube with Beads

- Supine position. Neck Extension.
- Nasal Intubation for GA
- EUA
- ADVANTAGE: Self retaining assembly, no suturing required

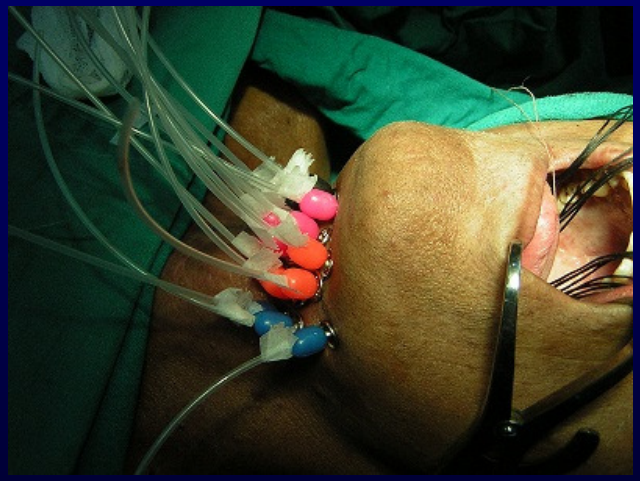
  No tubes protruding outside mouth (only threads). Pt. Comfort, Oral Examination.

  Beads create a space with palate reducing dose delivered to palate (spare minor saliv gl)

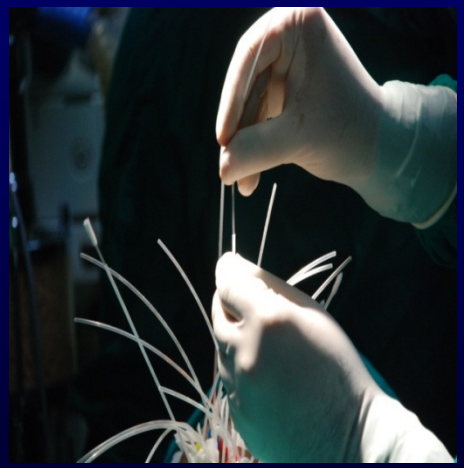
Steps of Procedure: Base of tongue

Tongue stitch

Needle insertion: Guided with intraoral palpation

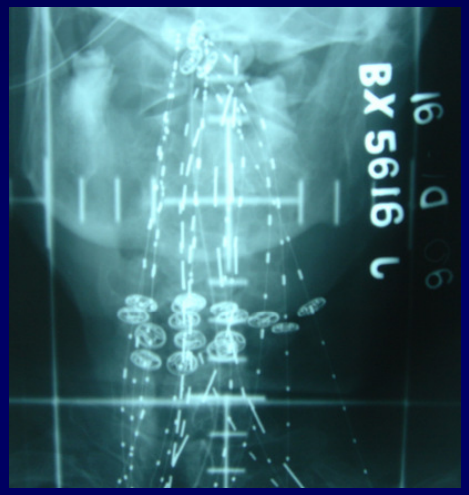


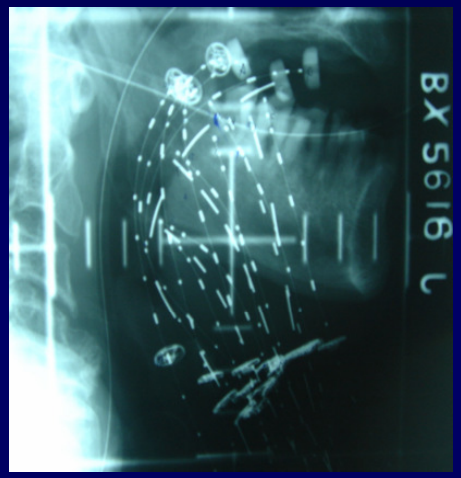
Completed implant



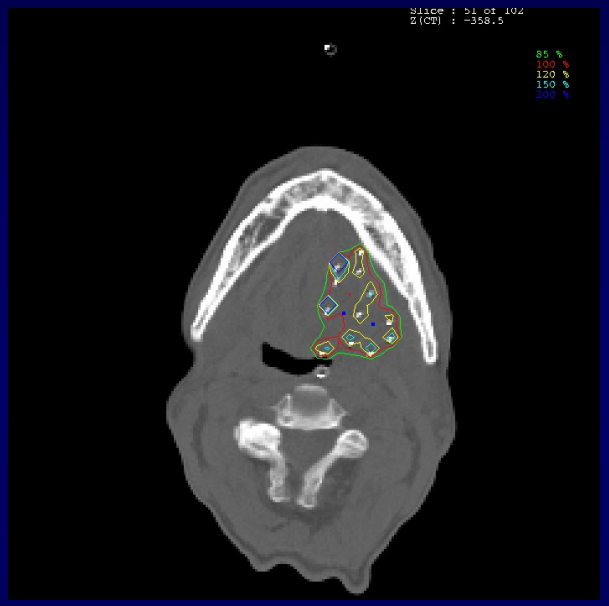
Re-enforcement in palstic tubes

Planning of Brachytherapy





X ray based planning



CT based planning

Treatment Delivery

After completion of External RT to a dose of 50-56Gy

Dose of brachytherapy: 20-28Gy LDR equivalent

Interstitial Brachytherapy for oral and oropharyngeal malignancies (N=1344)

- Patients treated between 1973-1992
- Oropharynx
  - Base of tongue (N=72)
  - Tonsil, soft palate, posterior pillar (N=271)
  - Anterior pillar,glossopharyngeal sulcus (N=90)

Location	T1 (%)		T2 (%)		T3 (%)	
	SS	OS	SS	OS	SS	OS
Mobile tongue	81	70	47	42	28	29
Floor of mouth	88	71	47	42	36	35
Base of tongue	76	48	62	49	43	38
Tonsil, soft palate, posterior pillar	88	65	78	63	53	49
Anterior pillar, glossopharyngeal sulcus	55	48	43	38	27	27

Pernot M. Otolaryngology 1996.

Outcome with interstitial brachytherapy for base of tongue cancer

First author, year	No. patients	% patients with T3–4	Median EB Dose, Gy	Median implant Dose, Gy	Technique	Chemotherapy	Primary control	Time point	Osteonecrosis
Housset,[13] 1987	29	0	45	30–35*	Loop	None	80%	8 y	3%
Puthawala,[14] 1988	70	74%	45–50	20–25 (T1–2) 30–40 (T3–4)	GB-V†	None	83%	5 y‡	3%
Crook,[12] 1988	48§	0	48.6	32*	Loop/Hairpin	None	75%	5 y	6%
Lusinchi,[15] 1989	108	47%	45	43.8*	Loop	None	64%	5 y	None
Horowitz,[16] 1986	20	45%	54	27	GB-VII	25%	90%	5 y	None
Harrison,[17] 1998	68	28%	54	20–25 (T1–2) 25–30 (T3–4)	Loop	13%	89%	5 y	3%
Demanes,[18] 2000	25	48%	54	19.2–36.9	GB-V	None	92%	5 y	None
Robertson,[19] 2001	20	35%	50–54	28.7	Loop	None	NR	NR	NR
Gibbs,[20] 2003	41	50%	50	26	Loop	5%	82%	5 y	5%
Karakoyun-Celik,# 2005	40	54%	61	17.4	GB-V	60%	78%	5 y	5%

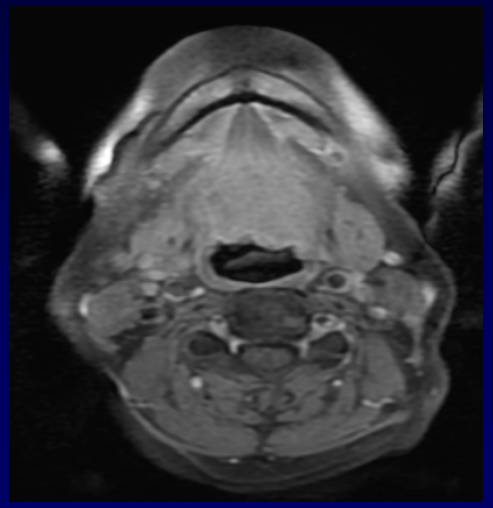
Karakyuon Celik. Head and Neck 2005

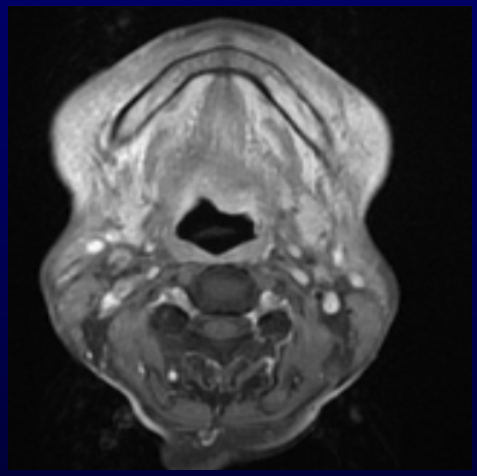
Outcome with interstitial brachytherapy for oral cavity and oropharyngeal tumors

Anatomical site	Patient selection	Implant technique	Safety margin	Dose	Result
Lip	T1-3	RN	5–10 mm	60–75 Gy LDR-PDR	LC: 90–95% N: 2–10%
Buccal mucosa	<4 cm	PT	5–10 mm	65–70 Gy LDR-PDR (25–30 Gy boost if 45–50 Gy ERT)	LC: 80–90% N: <10%
Mobile tongue	T1-3	PT	5 mm	65–75 Gy LDR-PDR (25–30 Gy boost if 40–45 Gy ERT)	LR: >90% N: 10–20%
Floor of mouth	T1-2N0	RN or PT	>5 mm	65 Gy LDR-PDR (10–25 Gy boost if 46-50 Gy ERT)	LR: >90% N: 10–30%
Oropharynx	< 5 cm	PT	>10 mm	LDR-PDR: 25–35 Gy boost following 45–50 Gy ERT HDR 21–30 Gy/3 Gy fractions or 21–24 Gy/ 4 Gy fractions boost following 45–50 Gy ERT	Base of tongue: LR: T1-2 80–90% T3-4 65–80%. N 25% Faucial arch: LR: T1-2: up to 90%. T3: 67%. N: 20%

Mazeron JJ. Radiother Oncol. 2009

Clinical Outcome: Base of tongue cancer





Clinical Outcome: Carcinoma soft palate

Clinical Outcome: Carcinoma tonsil

Outcome Analysis
January 1988-December 2004
(N=291)

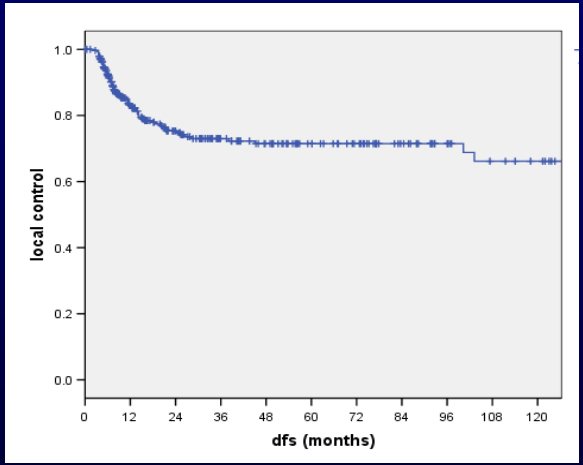
- Combination of External Beam radiation therapy and boost brachytherapy
- External RT: 60Cobalt : Median dose: 50Gy
- Brachytherapy: 192 Iridium Low dose rate system
- Median dose: 26Gy (15-40Gy)
- Oropharynx: 80%
- Node negative: 84%

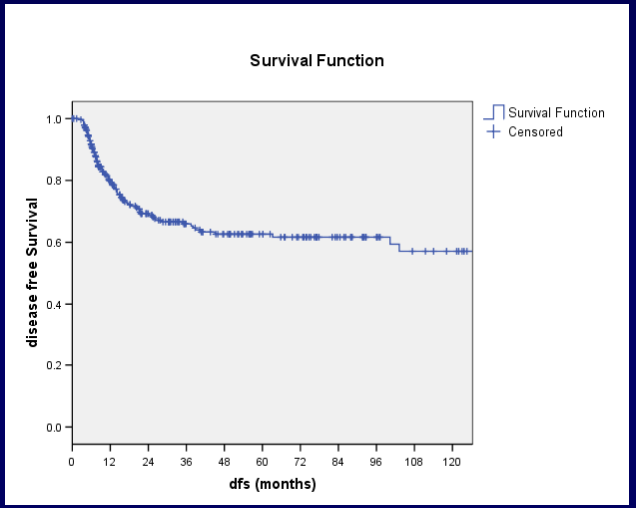
Budrukkar A et al. Radiother Oncol 2010 (abst)

Results: Outcome

- Median follow up of surviving patients: 35 months (4-243months)
- Median time to recurrence: 10 months

3 year local control: 73%





3 year Disease free survival: 66%

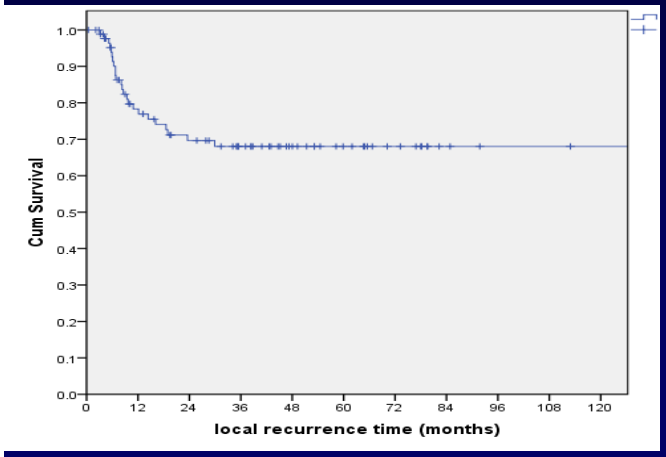
3 year overall survival: 63%

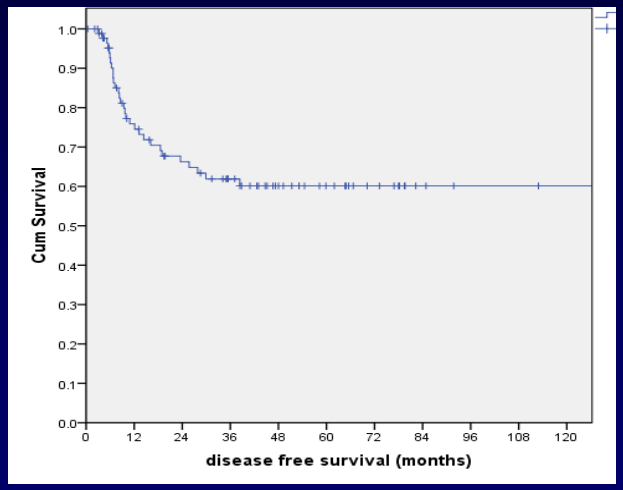
High Dose Rate Brachytherapy: TMH Experience

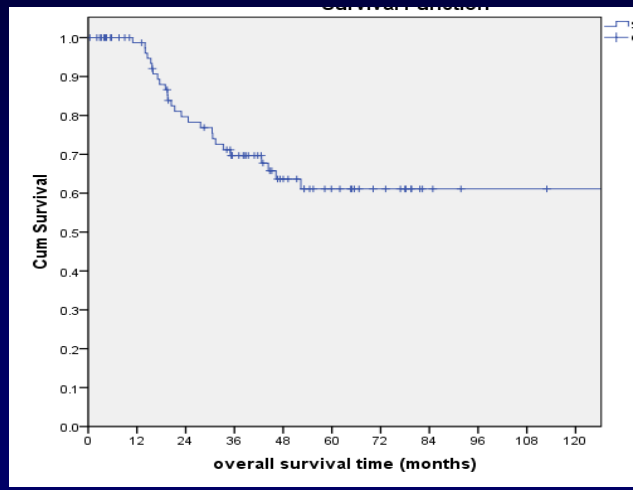
- Audit: January 1996- December 2007
- Number of Patients=88
- Radical radiation therapy+/- chemotherapy
- Combination external RT+ High dose rate brachytherapy boost
- Median age: 54 years
- Oropharynx: 74%
- T2-T3: 71%
- Node negative: 83%
- Median dose of Brachytherapy: 20.25Gy (10-36Gy)
- No of fractions: 5 (2-8)
- Dose per fraction: 450cGy (300-550cGy)

Budrukkar A et al. Radiother Oncol 2011(abst)

Survival







Local Control **Disease free survival** **Overall survival**

3 and 5 year Local Control rate: 68%

Median follow up of surviving patients: 43 months (2-168months)

Median time to recurrence: 8.4 months

3 and 5 year disease free survival: 62% and 60% respectively

3 and 5 year overall survival: 70% and 61% respectively

Xerostomia and Dysphagia related Quality of life after brachytherapy

- Patients of head and neck cancer treated with brachytherapy (either alone or combination with external RT)
- Attended follow up clinic and were controlled at last follow up Jan 2008-Jan 2009

•51 consecutive eligible patients who attended follow up clinic of a single head and neck unit

•Cross sectional evaluation using XQ and DQ

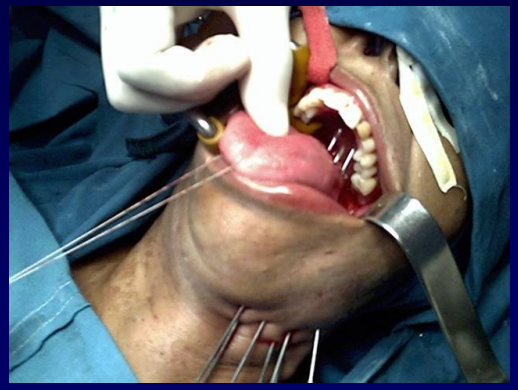
•Median XQ score : 16 (Low score less xerostomia)

•Median DQ score: 2.4 (Higher score low dysphagia)

	Eisbruch et al	Present study
Radiation	External Beam RT	External Beam RT+ Brachytherapy
Technique of External RT	IMRT	Conventional
Median follow up	12 months	50 months
Median XQ	35	16

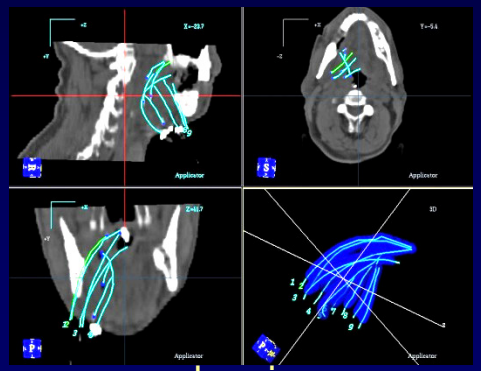
Budrukkar A et al. Eur J Cancer.2009 vol 7 (2) abst

3D CT based brachytherapy planning
Jan 2008- May 2010

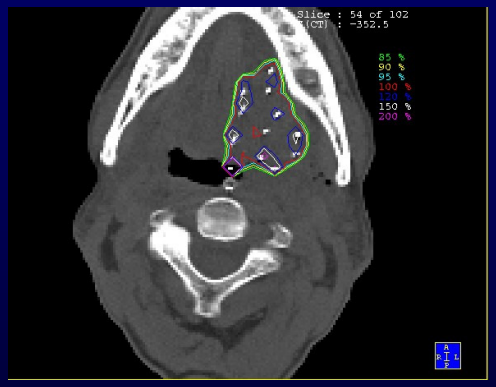


Brachytherapy procedure

CT scan



planning



Dose distribution

treatment

Number of brachytherapy procedures: 50

Ext RT+ Brachytherapy

HDR

CT based planning with 3 Gy per fraction bid

Base of tongue and tonsil: most common sites

Summary

- Brachytherapy for oropharyngeal tumors challenging
- Expertise is required for good placement
- Plastic tube techniques: Best suited for HDR brachytherapy
- Acceptable local control rates
- Low complication rates